

CLAIMS

What is claimed is:

1. In a system for supplying electrical energy to a load from a direct electrical energy converter, an arrangement for optimizing converter power generation efficiency comprising:

an impedance transformation circuit coupled between the energy converter and load for regulating current delivered by the energy converter so as to maximize power delivered to the load.

2. The arrangement of claim 1 wherein the impedance transformation circuit comprises:

a power switch operative in a first state to conduct current from the energy converter to the load and operative in a second state to inhibit energy converter current from reaching the load; and

a controller operative to place the power switch in its first and second states in accordance with a desired duty cycle.

3. The arrangement of claim 2 wherein the controller further comprises:

an energy converter output current sensor;

an energy converter output voltage sensor; and

a stored program processor unit coupled for receipt of signals from the energy converter output current and output voltage sensors and operative to regulate the desired duty cycle in accordance with received sensor signals.

4. The arrangement of claim 3 wherein the controller further comprises:

a load current sensor coupled to the processor unit; and

a load voltage sensor coupled to the processor unit;

whereby the sensor signals utilized by the processor unit to regulate the desired duty cycle further include signals from the load current and voltage sensors.

5. The arrangement of claim 1 further comprising:

a load voltage regulator coupled between an output of the impedance transformation circuit and the load.

6. The arrangement of claim 5 wherein the load voltage regulator comprises a DC/DC converter.

7. The arrangement of claim 5 further comprising:

a load balancing energy storage device coupled across the output of the impedance transformation circuit and an input of the load voltage regulator.

8. The arrangement of claim 7 wherein the load balancing energy storage device comprises a battery.

9. The arrangement of claim 7 wherein the load balancing energy storage device comprises an ultra-capacitor.

10. The arrangement of claim 1 wherein the energy converter is selected from the group consisting of: fuel cell, thermoelectric or thermoionic device, electrochemical battery, solar cell or photovoltaic converter, thermophotovoltaic system, plasma power generator, ferroelectric device, piezoelectric device, electrohydrodynamic generator.

11. A method of optimizing power generation efficiency of a direct electrical energy converter applying electrical current to a load, the method comprising:

monitoring output current and output voltage of the direct electrical energy converter;

monitoring current through and voltage across the load;

placing an impedance transformation circuit between the direct electrical energy converter and the load; and

adjusting impedance of the impedance transformation circuit as a function of monitored energy converter current and voltage and load current and voltage so as to maximize power delivered to the load.

12. The method of claim 11 wherein impedance of the impedance transformation circuit is adjusted by altering a duty cycle of a power switch operative in a first state to deliver the energy converter current to the load and operating in a second state to inhibit energy converter current from reaching the load.

13. The method of claim 12 wherein altering the duty cycle comprises:
changing a value of energy converter current delivered to the load by a predetermined amount, the polarity of the predetermined amount depending on whether a product of energy efficiency of the energy converter and power transfer efficiency from the energy converter to the load has changed.

14. The method of claim 13 wherein the polarity of the predetermined amount is reversed whenever the product has not changed.

15. The method of claim 13 wherein the polarity of the predetermined amount is reversed whenever the product changes positively and a present polarity of the predetermined amount is positive.

16. The method of claim 13 wherein the polarity of the predetermined amount is reversed whenever the product changes negatively and a present polarity of the predetermined amount is negative.

17. The method of claim 13 wherein the polarity of the predetermined amount is unchanged whenever the product changes in a direction opposite to the present polarity of the predetermined amount.